REMARKS

Favorable reconsideration of this application, in light of the following discussion, is respectfully requested.

Claims 1-20 are currently active in this application, the specification amended by way of the present amendment.

In the outstanding Office Action, claims 1-20 are rejected as failing to comply with the enablement requirement, and Claims 1-20 are rejected as being unpatentable over U.S. Patent No. 5,838,867(referred as ONISHI below) in view of U.S. Patent No. 6,301,419(referred as TSUKITANI below).

With regard to the objection to the specification, Applicant thanks the Examiner for indicating the error in format of abstract of the present application. The abstract has been replaced by way of present amendment. Therefore, the objection to the specification is believed to be overcome.

With regard to rejection of Claims 1-20 as failing to comply with the enablement requirement, the outstanding Official Action takes the position that the claimed limitation of "the apparent refractive index difference of said center core 1.15 to 1.40%" is not described in the specification in such a way as to enable one skilled in the art to make and/or use the invention because the specification "fails to disclose the value in which the center core is compared to and the formula used to calculate the apparent refractive index different of the center core." However, it is well settled that "[t]he test of enablement is whether one reasonably skilled in the art could make or use the invention from the disclosure in the patent coupled with information known in the art without undue experimentation." Applicants respectfully submit that one of

ordinary skill in the art reading the specification would understand that the "apparent refractive index difference of the center core" is the refractive index difference between the core material and the cladding layer, and could therefore make and/or use the claimed invention without undue experimentation.

Specifically, Figure 1A and the text corresponding thereto shows a cross section of a fiber having an inner core 11, side core layer 12 and cladding layer 13. Figure 1B shows a refractive index profile of the fiber of Figure 1A. In this regard, the lowest horizontal reference scale under the profile of Figure 1B indicates the portions of the profile that correspond to items 11, 12 and 13 of Figure 1A. That is, the center bulge of the profile shows the refractive index of the center core 11, the lowermost horizontal lines on both sides of the bulge show a refractive index value of the side core 12, and the highest horizontal lines on the outer edges of the profile show the refractive index value of the cladding layer. As also seen in Figure 1B, a vertical reference scale at the right side of the profile shows the value $\Delta 1$ extending from the refractive index of the cladding 13 to the maximum refractive index of the center core 11. The discussion beginning on page 13, line 12 of Applicant's specification defines the apparent refractive index difference of the center core 11 as "$\Delta 1$." Thus, it is clear from the specification that the "apparent refractive index difference of the center core" is the difference between the refractive index of the core material 11 and the refractive index of the cladding layer 13 as shown by the vertical reference scale of Figure 1B.

Based on the clarification given above, Applicant believes that the rejection under 35 U.S.C. 112, first paragraph is overcome.

Turning now to the prior art rejection under 35 U.S.C. 103(a), Applicant's invention is directed to an improved optical fiber. As described in the Background of Applicant's

specification, 1.31 single mode fibers are known to provide superior non-linearity, transmission loss, and polarization mode dispersion (PMD) characteristics, but provide poor positive dispersion and dispersion slope values at 1.55 μm wavelength. Moreover, Applicants have recognized that bending loss and effective area of the core material of a fiber are important to short range fiber applications where bending of the fiber may be necessary. Applicant's invention is directed to a fiber having improved dispersion and loss characteristics, while also having improved bending characteristics.

Specifically, as described in Applicant's specification, the inventors discovered that the physical parameter of b/a (diameter ratio of the side core layer to the center core of the fiber), bears an important relationship to effective area Aeff, which relates to the bending loss of the fiber. Based on this discovery, Applicant determined specific ranges of the physical parameters of $\Delta 1$ (apparent refractive index difference of the center core), α (profile of a distribution of refractive index of the center core), $\Delta 2$ (apparent refractive index difference of the center core), and b/a (diameter ratio of the side core layer to the center core) that provide improved dispersion value and loss for a fiber, while also providing good bending characteristics. Thus, each of independent Claims 1 and 10 recite a fiber having specific ranges of $\Delta 1$ and $\Delta 2$ in combination with "a constant α expressing a profile of a distribution of refractive index of the center core is 1.0 to 5.0" and "a diameter ratio (b/a) of a diameter (b) of said first side core layer to a diameter (a) of said center core is 1.6 to 2.4."

In contrast, the cited references do not disclose a diameter ratio (b/a) of a diameter (b) of said first side core layer to a diameter (a) of said center core is 1.6 to 2.4. Converting this b/a ratio range to the 2a/2b ratio of ONISHI results in a claimed range of .41 -.625, which the Official Action concludes overlaps the range of Ra(=2a/2b) =.3-.5 in ONISHI. Applicants note

that the range of ONISHI is based on the table of Figure 10 wherein the case where Ra equals 0.5 provides the upper limit to the range. However, as seen in Figure 10 and Figure 11, this 0.5 value is based on a positive dispersion fiber (dispersion = 2 in Figure 10) and therefore is inapplicable to Claims 1 and 10 where the claimed dispersion is negative to compensate the dispersion of the SMF. Eliminating the case of Ra = 0.5 from considerations results in a disclosed range of only 0.33 and 0.35, which does not overlap the claimed range.

Moreover, to the extent that either ONISHI or TSUKITANI disclose ranges that overlap the claimed b/a range, Applicant notes that this disclosure merely provides a prima facie case of obviousness that can be rebutted. As described above, the present inventors have discovered that the b/a ratio bears a close relationship to effective area and bending loss and failure to control this physical parameter can result in poor bending loss characteristics. It is well settled that this type of discovery of a problem can serve as a basis for patentability. Thus, Applicant submits that the discovery of the relationship of b/a to bending loss overcomes any obviousness that may be provided by overlapping b/a ratios in the cited references. Moreover, as discussed above, the b/a range, in combination with other recited ranges, provides the unexpected result of reduced bending loss.

In addition, the cited references do not disclose the constant α being 1.0-5.0 as also claimed in independent Claims 1 and 10. The cited reference to TSUKITANI is silent as to the constant α. While Figure 4A of ONISHI shows a profile similar to that shown in Applicant's Figure 1b, there is no discussion in ONISHI about the value of the constant α. As noted above, Applicants has discovered a specific range of values for the constant α that, in combination with the other claimed ranges, provides improved characteristics for a fiber.

Thus, the cited references to ONISHI and TSUKITANI do not disclose the claimed ranges of α and b/a physical parameters. As to the recited physical characteristics more generally, Applicant notes that Claims 1 and 10 recite a combination of specific ranges of $\Delta 1$, $\Delta 2$, α and b/a that provide the unexpected result of improved fiber dispersion and loss characteristics as well as improved bending characteristics, which are also recited in Claims 1 and 10. Applicant submits that it is because the cited references do not disclose the claimed physical characteristics of the fiber that these references also do not disclose the claimed improved operational characteristics of the fiber.

Specifically, Claims 1 and 10 also recite a transmission loss of 0 to 0.35 dB/km, a ratio of loss to dispersion (figure of merit (FOM)) of 120 to 500 (ps/nm)/dB, a polarization mode dispersion (PMD) of 0 to 0.15 ps/ $\sqrt{}$ km, and an effective core area (Aeff) of 19 to 50 μm2 when the wavelength of the light propagated through the center core is the 1.55 μm band, and a bending loss at a diameter of 20 mm of 0 to 5 dB/m.

In contrast, neither of ONISHI nor TSUKITANI discloses the claimed ratio of loss to dispersion. Moreover, ONISHI discloses a transmission loss of less than 0.5, which is broader than the improved range recited in Claims 1 and 10. TSUKITANI is silent as to this parameter. Still further the Official Action acknowledges that ONISHI doesn't disclose the value of Aeff. While TSUKITANI discloses the parameter should be 19 μm2 or more, this reference fails to disclose 50μm2 as an upper limit of this parameter. As discussed on page 16 lines 3-7 in the present application, the present inventors discovered that if Aeff is attempted to make it larger than 50μm2, the bending loss becomes much greater. None of experimental examples shown in Figs. 3-9 in TSUKITANI gives the combination of Aeff of 19 μm2 or more and bending loss of

5 dB/m or less as claimed in Applicant's independent Claims 1 and 10. Finally, ONISHI and TSUKITANI disclose very generally that the bending loss is less than 100 dB/m and less than 50dB/m respectively, while Claims 1 and 10 recite the narrower improved range of 0-5dB/m.

As discussed above, independent Claims 1 and 10 recite a combination of physical characteristics of a fiber that provide improved operational characteristics for the fiber. While the cited references discuss some of the recited physical parameters, these references do not disclose the specific ranges of parameter values recited, or the combination of ranges recited. Thus, the cited references also do not disclose the improved operational characteristics recited in Claims 1 and 10. Thus, Claims 1 and 10 patentably define over the cited references. Moreover, as Claims 2-9 and 11-20 depend from Claims 1 and 10 respectively, these claims also patentably define over the cited references.

Consequently, in view of the present amendment, no further issues are believed to be outstanding in the present application, and the present application is believed to be in condition for formal Allowance. An early and favorable action is therefore respectfully requested.

Respectfully submitted,

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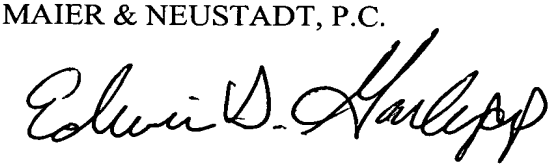

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